

## Cryptomonads of Japan (2) Three Species of *Chroomonas*

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### 日本産クリプト藻類 (2) クロオモナスの3種

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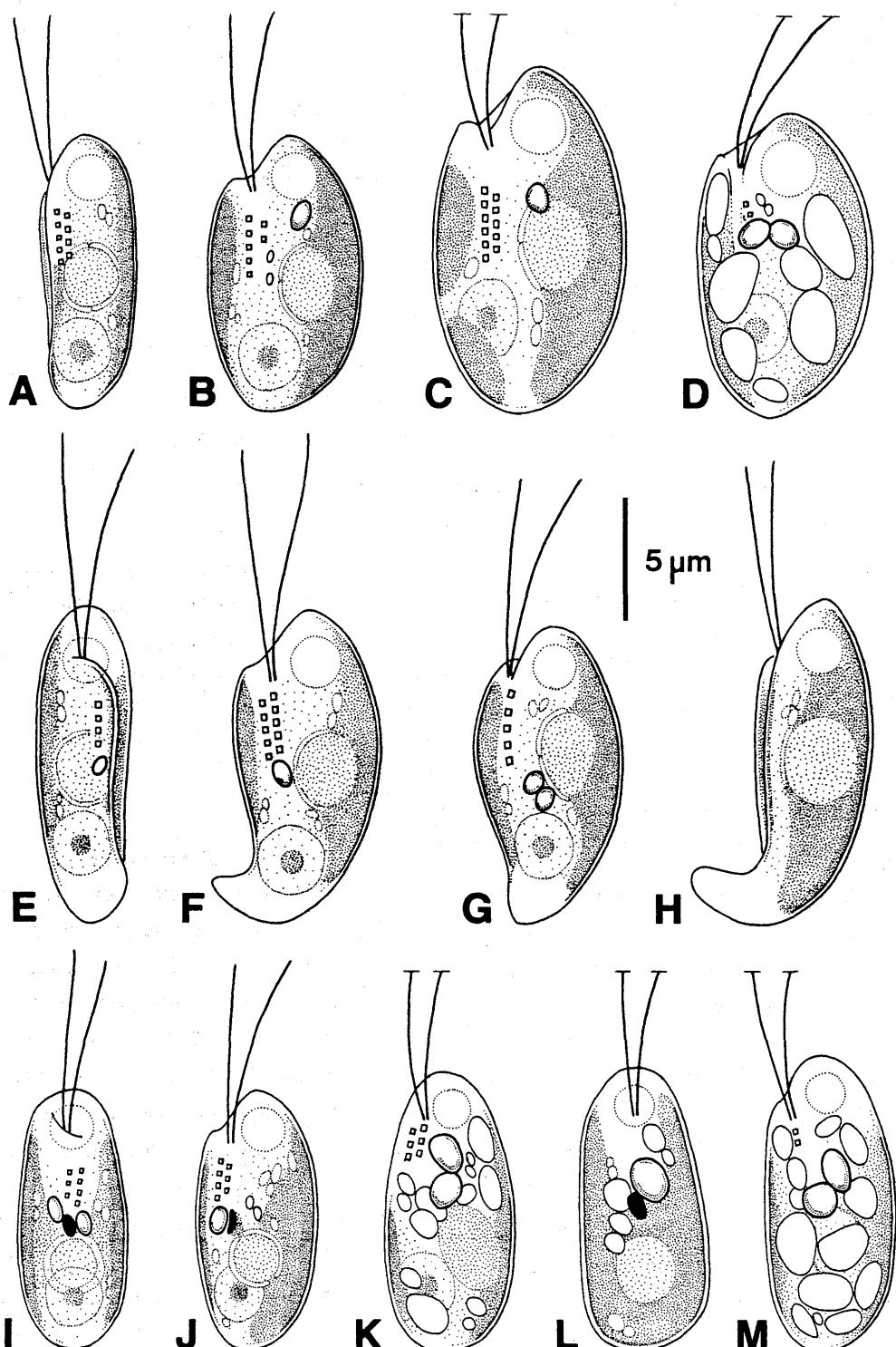
Three species of *Chroomonas* (Class Cryptophyceae) were described on the basis of the specimens collected from the freshwater of Japan: 1) *Chroomonas nordstedtii* Hansgirg, 2) *C. caudata* Geitler, and 3) *C. coerulea* (Geitler) Skuja. They all have one blue-green chloroplast and one pyrenoid. Under cultural condition, they tend to accumulate cell content, such as starch grains, and increase their cell size, though the color of chloroplast does not change.

(Continued from J. Jpn. Bot. 59: 161-169, 1984.)

Since our previous paper (Ishimitsu and Chihara 1984) appeared, several papers (Santore 1984, Hill and Wetherbee 1986, Kugrens and Lee 1987, etc.) have been published on the taxonomy of the Cryptophyceae, but most of them dealt with the systematics or the circumscription of the genera on the basis of ultrastructural information and none of the papers was concerned with the floristic aspect of this group of algae. We have continued to collect specimens of the cryptomonads in freshwater environment in Japan and examined their characteristics using cultured materials for obtaining better understanding of the Japanese representatives. This paper is the second of a series of floristic studies on the cryptomonads in Japan and deals with three species of the genus *Chroomonas*.

### Material and methods

Specimens were collected from various places of Japan, which will be indicated in the description of species examined. Methods for isolation and culture conditions are the same as the previous work (Ishimitsu and Chihara 1984) except for the culture medium. Most of *Chroomonas* strains were maintained well in modified AF-6 medium. The component of original AF-6 medium (Kato 1981) is as follows:  $\text{NaNO}_3$ , 14 mg;  $\text{NH}_4\text{NO}_3$ , 2.2 mg;  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ , 3 mg;  $\text{KH}_2\text{PO}_4$ , 1 mg;  $\text{K}_2\text{HPO}_4$ , 0.5 mg;  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ , 1 mg;  $\text{CaCO}_3$ , 1 mg; Fe-citrate, 0.2 mg; citric acid, 0.2 mg; biotin, 0.2  $\mu\text{g}$ ; thiamine HCl, 1  $\mu\text{g}$ ; vitamin B<sub>6</sub>, 0.1  $\mu\text{g}$ ; vitamin B<sub>12</sub>, 0.1  $\mu\text{g}$ ; trace metals, 0.5 ml; MES, 50 mg; distilled water, 99.5 ml; pH 6.6. For modified medium,  $\text{CaCO}_3$  is removed and 0.5 ml



Figs. A–D. *Chroomonas nordstedtii* Hansgirg. A: lateral view. B–C: ventral view. D: specimen in the aged culture. Figs. E–H. *C. caudata* Geitler. E: lateral view. F: ventral view. G: specimen with less-developed posterior end. H: specimen showing the subsidence on the ventral surface. Figs. I–M. *C. coerulea* (Geitler) Skuja. I: lateral view. J: ventral view. K–M: specimens in the aged culture.

of P IV metals are added instead of trace metals. Method for observation is the same as that described in the previous paper (Ishimitsu and Chihara 1984).

### Description of species

1) ***Chroomonas nordstedtii*** Hansgirg, Bot. Centralbl. **23**: 230, 1885; Skuja, Symb. Bot. Upsal. **9(3)**: 349, pl. 37, f. 22–23, 1948; Huber-Pestalozzi, Phytoplank. Süßwas. **3**: 28, pl. 3, f. 13, 1950. (Figs. A–D)

Cells ellipsoidal to obovate, dorsiventrally more or less compressed, with obliquely truncate anterior and rounded to slightly subacute posterior end, straight to somewhat convex at both lateral sides, rarely concave at right side, 9–13  $\mu\text{m}$  in length, 4.5–7  $\mu\text{m}$  in width, 3.5–4.5  $\mu\text{m}$  in thickness; furrow and gullet not obvious, with 1–2 rows of trichocysts being shorter than the half of cell length; chloroplast one, blue-green, usually covering the cell entirely; pyrenoid single, with a sheath of starch grains, situated dorsally in the center of the cell; eyespot absent; contractile vacuole situated anteriorly; nucleus located posteriorly; refractive body single or two, centrally located near the ventral side; flagella two, subequal in length, about 2/3 times the cell length; cell division taking place while swimming.

Habitat: occurring in marsh and ponds.

Type locality: near Prague, Czechoslovakia.

Geographical distribution: Europe, North America, Australia and Japan.

Specimens examined: Botanical Garden, Sapporo-shi, Hokkaido, September 24, 1987 (M. Erata, #00324, 330, 331); Yoshino Park, Mitsukaido-shi, Ibaraki-ken, January 17, 1987, isolated by S. Suda (M. Erata, #00355); Funadaike, Chiba-shi, Chiba-ken, September 13, 1985 (M. Erata, #00173); Sugadaira, Sanada-cho, Nagano-ken, July 22, 1983 (M. Erata), September, 1976,

collected and isolated by I. Inouye (M. Erata, #00165)<sup>1)</sup>.

Our specimens agree well with Skuja's (1948) description. This species is similar to *C. coerulea* (Geitler) Skuja, but differs by the absence of eyespot. The starch sheath of pyrenoid is often not evident. Specimens from Hokkaido are somewhat larger in cell size (12–15  $\mu\text{m}$  in length, 7–10  $\mu\text{m}$  in width, 4.5–6.5  $\mu\text{m}$  in thickness) than those from other localities (cf. Fig. C).

Cells from nature usually contain very little amount of starch grains. In culture cells often accumulate starch grains (Fig. D) and increase their size. However, color of the chloroplast is stable even in culture, though it becomes rather paler. Other two species described below also have a similar tendency.

2) ***Chroomonas caudata*** Geitler, Österr. Bot. Z. **73**: 246, f. a–h, 1924; Huber-Pestalozzi, Phytoplank. Süßwas. **3**: 34, pl. 3, f. 20, 1950; Ettl, Bot. Tidsskr. **74**: 192, pl. 7, f. 3–5, 1980. (Figs. E–H.)

Cells obconical to elongately obovate, dorsiventrally more or less compressed, with obliquely truncate anterior and tapered and recurved posterior end, more convex at left side than right side, 9–14  $\mu\text{m}$  in length, 5–8  $\mu\text{m}$  in width, 4–6  $\mu\text{m}$  in thickness; furrow not evident, gullet with 1–2 rows of trichocysts extending from the emerging point of the flagella to almost center of the cell; chloroplast one, blue-green, occupying most of the cell periphery except the posterior part; pyrenoid single, with a sheath of starch grains, located centrally; eyespot absent; contractile vacuole situated anteriorly; nucleus near the base of the cell; flagella two, subequal in length, somewhat shorter than the cell length; refractive body rarely present, single or two, near the end of the gullet; cell division occurring while swimming.

Habitat: occurring in ponds.  
 Type locality: Lunzer See, Austria.  
 Geographical distribution: Central Europe, Japan.  
 Specimen examined: Funada-ike, Chiba-shi, Chiba-ken, September 13, 1985 (M. Erata, #00171<sup>1)</sup>).

Our alga agrees well with the original description given by Geitler (1924). This species is easily recognized by its comma-shaped outline of the cell. It is similar to *C. acuta* Utermöhl, but differs by the shape of the posterior end of cell: the latter has an apparently acute posterior end, while the former's is never pointed.

The extent of cell curvature at the posterior end is varied depending on the condition of culture. When culture becomes aged, some of the cells tend to have no curved posterior end (Fig. G). It is not easy to observe the furrow for this species because the cell surface subsides along the furrow (Fig. H).

3) *Chroomonas coerulea* (Geitler) Skuja, Symb. Bot. Upsal. 9(3): 350, pl. 37, F. 24–25, 1948; Huber-Pestalozzi, Phytoplank. Süßwas. 3: 27, pl. 3, f. 12, 1950.

Basionym: *Cryptomonas coerulea* Geitler, Int. Revue d. ges. Hydrobiol. u. Hydrog. 10: 684, f. a–b, 1922. (Figs. I–M)

Cells ellipsoidal to cylindrical, dorsiventrally slightly compressed, with obliquely truncate anterior and rounded posterior, straight or very slightly concave at right side, convex at left side, 9–12  $\mu\text{m}$  in length, 4.5–5.5  $\mu\text{m}$  in width, 4–5  $\mu\text{m}$  in thickness; furrow not evident, gullet with 1–2 rows of trichocysts shorter than the half of cell length; chloroplast single, occupying the cell periphery almost entirely; pyrenoid single, with a distinct sheath of starch grains, located somewhat posteriorly; eyespot present, just above the pyrenoid, facing to the ventral surface of the cell; contractile vacuole anteriorly, nucleus posteriorly;

refractive body often present, single or two, conspicuous, located near the eyespot; several reflexive globules sometimes scattered; flagella two, subequal in length, somewhat shorter than the cell length; often embedded in a gelatinous matrix, forming pallmeloid stage, cell division occurring in that state.

Habitat: occurring in marsh.  
 Type locality: Lunzer See, Austria.  
 Geographical distribution: Northern and Central Europe, Japan.  
 Specimens examined: Sugadaira, Sanada-cho, Nagano-ken, November 10, 1985 (M. Erata, #00191, 217<sup>1)</sup>).

Our alga agrees well with the original description (Geitler 1922) except the following point: Geitler reported that this species had an eyespot in the specimens collected from nature but lost it during culture. Our specimens still keep eyespot under culture. Presence of the eyespot is one of the most conspicuous characters of this species. There are two freshwater species so far known to possess eyespot in *Chroomonas*: *C. rosenbergae* and *C. pochmanni*. The former has broadly ovate outline of the cell and the latter has two chloroplasts, so both can be easily distinguished from this species. This species is also characteristic in having conspicuous refractive body. Under aged culture, this body tends to become larger and well-developed (Figs. K–M).

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#### Endnote

1) Will be deposited in the NIES Collection

(Microbial Culture Collection, The National Institute for Environmental Studies, Tsukuba).

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### 要 旨

日本産クロオモナス属の淡水産種3種 1) *Chroomonas nordstedtii* Hansgirg, 2) *C. caudata* Geitler および 3) *C. coerulea* (Geitler) Skuja について報告した。3種はいずれも青緑色の葉緑体と1個のピレノイドをもつ。これら3種では、培養が進むにつれて細胞内にデンプン粒の増加や彩光体の発達が生じ、またそれにともなう細胞の肥大化等の傾向がみられる。しかし、葉緑体の色調はやや退色が起こる程度で大きな変化はない。